

The Visual and Auditory Reaction Time of Adolescents with Respect to Their Academic Achievements

Cengiz Taskin

Correspondence: Cengiz Taskin, School of Physical Education and Sports, Batman University, Batman, Türkiye.

Received: February 14, 2016 Accepted: February 18, 2016 Online Published: February 23, 2016

doi:10.11114/jets.v4i3.1374

URL: <http://dx.doi.org/10.11114/jets.v4i3.1374>

Abstract

The aim of this study was to examine in visual and auditory reaction time of adolescents with respect to their academic achievement level. Five hundred adolescent children from the Turkey, (age=15.24 \pm 0.78 years; height=168.80 \pm 4.89 cm; weight=65.24 \pm 4.30 kg) for two hundred fifty male and (age=15.28 \pm 0.74; height=160.40 \pm 5.77 cm; weight=55.32 \pm 4.13 kg) for two hundred fifty female, participated as volunteer in this research. The audio and visual reaction time assessments were made by Newtest 1/1000 reaction timer. The reaction times of subjects were taken in same conditions. Academic achievement level was considered as grade average of lesson ninth and tenth class. Visual and auditory reaction time in right and left hand was significantly different between academic achievement score that is 50-60 grades, 61-70 grades, 71-80 grades, and 81 \leq grades. When the visual and auditory reaction time for right and left hand was analyzed with respect to academic achievement of adolescent children, it was found that the visual and auditory reaction time for right and left hand of 81 \leq grades were better than the visual and auditory reaction time for right and left hand of 50-60, 61-70, and 71-80 grades ($p < 0.05$). Visual and auditory reaction time in right and left hand was significantly different between female and male ($P < 0.05$). In conclusion, it is considered that male adolescents children' reaction time is better than female children. We can connect the motor skills could be developed than in female for adolescents. Also, when academic achievement increased reaction time could be decreased for adolescent children.

Keywords: adolescent, academic achievement, reaction time

1. Introduction

In recent years scientists involved in the field of education and scientists involved in the field of sport have done their researches together in order to achieve more in individuals' daily lives. The alive beings have shown reactions against current chemical and physical events around them. Changes which lead to these relevant reactions are regarded as effects or warnings (Karbek, 1990). The creatures react to warnings given to them. We can define reaction as an individual's response to a warning one receives. Response time is also defined as the elapsed time between warning to come and response to warning (Angel, & Moore, 2000). They suggest that response time may be reduced with physical practices (Kolayış, 2000). In order to get achievements in individuals' education, affective learning has a highly important place. The elapsed time between stimulus and response is regarded as delay in learning. Shortness of delay increases the value of immediate response power. Revelation of learned response depends on the existence of impulses and the power of habits. The power of connection between stimulus and response is called habit strength. For learning any information, the state of arousal is a substantial factor, any organism needs to have arousal at a certain level. As an individual has difficulties in learning at a low arousal level, this one will have difficulties in learning at a high arousal level. Arousal levels in individuals are factors which reflect their physiological and psychological situations. When we consider response time, it shows a person' physiological condition but is affected from psychological factors. An interaction between the arousal level and the response time is a matter of subject (Baboo, Rajan, Ramachandra, & Venkatesh, 2002). Morgan (1977) describes arousal as wakefulness level, readiness and increase in muscle tension. This situation is not different in athletes as well. To indicate the required performance, an appropriate arousal level must be. Otherwise, the required performance is not achieved (Azboy, Erer, Oymak, & Tunç, 2012). Janelle (2002) reports that visual attention is negatively affected in athletes with high arousal levels. In learning activity the speed of processing and attention keep an important place. Information received is subjected to the proceeding system, herein the relevant changes lead to learning. Considering that the speed of response to stimuli regarding intellectual performance coming from outside involves response time in our brain, we can define relation between proceeding speed and response time as an indicator of speed of thinking (Karakas, 2012). Attention which is regarded as any focus on an intellectual activity, is

an intensive-perceptional situation aimed at a certain target in learning activity. Within this perception leading to physiological changes in individuals, sense organs are targeted on that current event or person without ignoring any details. Positions of sense organs are accompanied by persons' physical situation. Factors which involve attention, a mental arousal situation and selection (Anderson, 1989). Persons are exposed to many stimulants at each hour of a day during their lives. But individuals may only perceive stimulants which pay their attention among these stimulants. For carrying out learning activity, an individual needs to put one's attention on the subject to be learned. When an individual does not pay attention to the stimulant in the process of learning enough, effective learning will not be achieved. As it can be seen, an issue of attention is a factor which plays the main role in learning process. Attention is also among factors affecting response time. Individuals' concentration situations are made up of different factors such as possible external distracters, capability of focusing on any target and focus time and this affects response time. All these factors are related with individuals' capability to direct their attention towards a certain target (Agnew, Schwartz, Bolla, Ford, & Blecker, 1991). Bompa states that attention is an important issue in developing complex response time and visually perceiving a movable object (Bompa, 1990). Reaction time is in interaction with concentration, attention, and arousal level and information process skills which have important places in individuals' learning process.

Therefore, our study aims to measure the relation between visual and audio response time and academic success level in high school students.

2. Method

Five hundred adolescent children from the Turkey, (age=15.24 \pm 0.78 years; height=168.80 \pm 4.89 cm; weight=65.24 \pm 4.30 kg) for two hundred fifty male and (age=15.28 \pm 0.74; height=160.40 \pm 5.77 cm; weight=55.32 \pm 4.13 kg) for two hundred fifty female, participated as volunteer in this research. They were not having any pathology or injury and were not suffering from any psychiatric disorder affecting their psychomotor abilities. Each of these conditions could be responsible in affecting reaction time performance and could become a confounding factor in the study. The subjects were informed about the nature of the study and a written consent was obtained.

Adolescent children were being educated at the high school of Yahya Kemal Beyatlı in Gaziantep from Turkey. Academic achievement level was considered as grade average of lesson ninth and tenth class.

2.1 Measurements

2.1.1 Body Height

Body height of adolescent children was measurement with 0.1 kg sensitive electronic stadiometer (SECA, Germany) (Lohman, Roche, & Martorell, 1988).

2.1.2 Body Weight

Body weight of adolescent children was measurement as bare feet, shorts, T-shirts with 0.1 kg sensitive electronic weighbridge (SECA, Germany) (Gordon, Chumlea, & Roche, 1988).

2.2 Reaction Time

The audio and visual reaction time in right and left hand assessments were made by Newtest 1/1000 sensitive reaction timer. We expressed to press the button with forefinger in three second with ready command after concentrate on test from adolescent children. Each adolescent child was given five attempts that are out of the evaluation. Later, each adolescent child applied five times in reaction time right and left hand. Lowest and highest reaction time was out of the evaluation. The other three measurements means were recorded as reaction time (in ms). The reaction times of subjects were taken in same conditions (Tamer, 2000).

2.3 Academic Achievement

To determine academic achievement levels, we interviewed with high school management for children' all lesson mean score the ninth and tenth class. They were taken from school management. All lesson grade average divided four groups (50-60, 61-70, 71-80, and 81 \leq) in the ninth and tenth class.

2.4 Statistical Analysis

We summarized the data and evaluated the means and Standard deviations. To explain differences between academic achievement grades, one-way analysis of variance was used with respect to the results of the test of normality and a Tukey test from posthoc multiple comparison test was used with respect to the results of the homogeneity of variance. Also, we used indepedend groups T-test for gender. We used SPSS 14.0 statistical program for data analyses. The significant level was taken as 0.05.

3. Findings

Table 1. Mean values and standard deviation of age and height and weight for both groups

Variables		Age (years)	Height (cm)	Weight (kg)
Gender	Female (N=250)	15.28 \pm 0.74	160.40 \pm 5.77	55.32 \pm 4.13
	Male (N=250)	15.24 \pm 0.78	168.80 \pm 4.89	65.24 \pm 4.30
	50-60 (N=125)	15.33 \pm 0.65	163.33 \pm 10.33	59.17 \pm 6.82
Academic achievement score	61-70 (N=125)	15.33 \pm 0.78	165.17 \pm 5.51	61.00 \pm 7.26
	71-80 (N=125)	15.08 \pm 0.86	163.54 \pm 5.99	59.46 \pm 6.64
	81 \leq (N=125)	15.31 \pm 0.75	166.31 \pm 4.48	61.46 \pm 5.88

Table 2. Mean values (in ms) and standard deviation of visual and auditory reaction times for both groups

Variables	Visual Reaction time (ms)		Auditory Reaction time (ms)	
	Right hand	Left hand	Right hand	Left hand
Gender	Female	273 \pm 21.97	279 \pm 23.38	282 \pm 28.20
	Male	241 \pm 16.44	243 \pm 16.17	242 \pm 15.06
	50-60	282 \pm 24.66	286 \pm 26.79	290 \pm 33.66
Academic achievement score	61-70	262 \pm 14.72	270 \pm 21.57	270 \pm 21.37
	71-80	252 \pm 15.83	251 \pm 18.37	253 \pm 16.38
	81 \leq	235 \pm 18.40	240 \pm 18.07	238 \pm 19.32

Table 3. Comparison of visual and auditory reaction times in gender

Variables		Gender	Mean	T	P
Visual Reaction time (ms)	Right hand	Female	273 \pm 21.97	5.789	0.000*
		Male	241 \pm 16.44		
	Left hand	Female	279 \pm 23.38	6.467	0.000*
		Male	243 \pm 16.17		
Auditory Reaction time (ms)	Right hand	Female	282 \pm 28.20	6.141	0.000*
		Male	242 \pm 15.06		
	Left hand	Female	287 \pm 33.75	5.865	0.000*
		Male	244 \pm 15.16		

*P<0.05

Table 3 shows the visual reaction time in right hand and left hand, auditory reaction time in right hand and left hand in gender. Visual and auditory reaction time in right and left hand was significantly different between Female and male.

Table 4. Comparison of visual and auditory reaction times in academic achievement score

Variables		Sum of Squares	Df	Mean Square	F	Sig.
Visual Reaction time (ms) in right hand	Between Groups	14539,545	3	4846,515	13,814	0,000*
Visual Reaction time (ms) in left hand	Between Groups	15323,452	3	5107,817	11,202	0,000*
Auditory Reaction time (ms) in right hand	Between Groups	18615,641	3	6205,214	11,334	0,000*
Auditory Reaction time (ms) in left hand	Between Groups	16778,261	3	5592,754	6,493	0,001*

*P<0.05

Table 4 shows the visual reaction time in right hand and left hand, auditory reaction time in right hand and left hand in academic achievement score. Visual and auditory reaction time in right and left hand was significantly different between academic achievement score that is 50-60, 61-70, 71-80, and 81 \leq .

Table 5. Multiple comparison of visual and auditory reaction times in academic achievement score

Dependent Variable	(I) academic achievement score	(J) academic achievement score	Mean (I-J)	Difference	Std. Error	Sig.	
Visual Reaction time (ms) in right hand	50-60	61-70	20.48	7.647	0.049*		
		71-80	29.99	7.498	0.001*		
		81≤	47.31	7.498	0.000*		
		50-60	-20.48	7.647	0.049*		
	61-70	71-80	9.51	7.498	0.587		
		81≤	26.83	7.498	0.004*		
		50-60	-29.99	7.498	0.001*		
		71-80	-9.51	7.498	0.587		
	71-80	81≤	17.32	7.347	0.100		
		61-70	16.02	8.718	0.269		
		50-60	34.60	8.548	0.001*		
		81≤	45.86	8.548	0.000*		
Visual Reaction time (ms) in left hand	61-70	50-60	-16.02	8.718	0.269		
		71-80	18.59	8.548	0.146		
		81≤	29.85	8.548	0.006*		
		50-60	-34.60	8.548	0.001*		
	71-80	61-70	-18.59	8.548	0.146		
		81≤	11.26	8.376	0.540		
		61-70	19.27	9.552	0.196		
		50-60	37.05	9.367	0.001*		
	50-60	81≤	51.59	9.367	0.000*		
		50-60	-19.27	9.552	0.196		
		71-80	17.78	9.367	0.243		
		81≤	32.32	9.367	0.006*		
Auditory Reaction time (ms) in right hand	71-80	50-60	-37.05	9.367	0.001*		
		61-70	-17.78	9.367	0.243		
		81≤	14.54	9.178	0.398		
		61-70	28.75	11.981	0.091		
	61-70	71-80	41.70	11.749	0.005*		
		81≤	47.94	11.749	0.001*		
		50-60	-28.75	11.981	0.091		
		71-80	12.95	11.749	0.690		
	50-60	81≤	19.19	11.749	0.370		
		50-60	-41.70	11.749	0.005*		
		71-80	61-70	-12.95	11.749	0.690	
		81≤	6.24	11.511	0.948		

* The mean difference is significant at the 0.05 level.

When the visual and auditory reaction time for right and left hand was analyzed with respect to academic achievement of adolescent children, it was found that the visual and auditory reaction time for right and left hand of 81≤grades were better than the visual and auditory reaction time for right and left hand of 50-60, 61-70, and 71-80 grades ($p < 0.05$).

4. Conclusion and Discussion

In learning skill, perceptual motor development has a significant place, in meeting effective learning functions; there is a need for perceptual motor development. Sensory information is taken, organized and re-plied appropriately with perceptual motor abilities. As a capability of perception performs its physical functions, plays effective roles in deciding what to do. Therefore, response time is closely related with perceptual motor development (Davis et al., 1995). Attention, concentration, arousal level and process speed affecting response time are significant variables which affect students' successes in learning process. One study clarifies that there is a significant relation between response time and process speed, response time is parallel with increases in process speed (Sarı, 2012). Response time vary in age, gender and individuals' intellectual characteristics. When we analyze response time in accordance with the physical characteristics of students participated in our study, males have more visual and audio response time rather than females. Also, right hand response time is better than left response time in both males and females. A previous study, Karagöz's study (2008) on children aged 8-10 found right hand as 404,2 ms, left hand as 427,75 ms in males' audio response time average and right hand as 420,75 ms, left hand as 457,6 ms in their visual response time average, right hand as 424,65 ms, left hand as 476,6 ms in females' audio response time average and right hand as 482,7 ms, left hand as 510,1 ms their visual response time average. Many researches indicate that females have slower response time rather than males. Bayar and Koruç's research (1992) on children aged 10-15 claims that response time in males aged 10 is longer than

females of same age but males' response time is shorter than females in future years. Another study on males and females aged 11-14 determines that males' response time is quicker than females (Taimela, & Kujala, 1992). Also, Ja-Song and Lynn (1993) suggest that female children have slower response time rather than male children in their research about English children. Due to the low level of arousal and attention deficit, it is observed that individuals having high response time do not care about stimulants coming from outside enough (Ganong, 2001). In persons with long response time problems negatively affecting response time such as failure to focus exactly, failure to concentrate may be seen. Another study states that response time in individuals having intellectual disability have worse values rather than normal individuals' response time (Lechair, Pollock, & Elliot, 1993). Since individuals having intellectual disability cannot focus on stimulus for a long time, they have longer response time than normal individuals. This explains that possible attention problem of individuals having long response time in courses will affect learning in a negative way and be included in factors preventing them to succeed in courses. However, success levels of disabled individuals having high physical skills are high, so their self-confidence levels are high too. One study finds that national hearing-impaired judoists' self-confidence is higher than ones not doing sport (Karakoç Çoban, & Konar, 2012). When we examine the relation between response time and academic success in our study, individuals having low academic success levels have longer response time regarding both right hand and left hand in terms of visual and audio response time. On contrary to this, subjects having high academic success levels have shorter response time regarding both right hand and left hand in terms of visual and audio response time. About the relation of intelligence level with response time, there are many researches available. Since individuals feel warnings outside with their senses, sense capacities of persons with high intelligence level develop. In another study, in order to analyze the relation of intelligence level with response time, tests which measure movement time and decision-making time were performed in Korean children and they found a statistically significant correlation between intelligence level and decision-making time (Ja-Song, & Lynn, 1993). Shigehisa and Lynn (1991) found a positive relation between intelligence and response time in their research about Japanese children. Attention and processing speed is very important in learning activities. Received warnings learning activities outside of the amendments contemplated in the processing system is created. In one study, there is a parallel relation between decision-making time, movement time, intelligence level and response time (Chan, Eysenck, & Lynn, 1991). Myung, & Lynn (1992) observed a statistically significant relation between response time and intelligence level in Korean children at the least. Lynn, Cooper and Topping (1990) determined a positive relation between children's psychometric intelligence, movement time and response time, said that intellectual practices affected response time. Then they did researches on children from different countries, evaluated the relation between intelligence level and response time and found similar results. A previous study, Orhan (2014) found a meaningful difference in favor of the group doing sport when comparing response time of one's doing sport and not doing sport. When we compare our research findings with other researches, the results are parallel with each other. In conclusion, it is considered that male students' reaction time is better than female students. We can connect the motor skills could be developed than in female for adolescents. For developing reaction time, neuromuscular junction exercises to be organized in annual training plans are considered to lead to positive effects in individuals' reaction time (Bompa, 1990)' in addition to this, academic success levels can develop in positive ways in comply with attention, concentration, arousal level and information process speed.

References

Agnew, J., Schwartz, B. S., Bolla, K., Ford, D. P., & Blecker, M. L. (1991). Comparison of computerized and examiner administered neurobehavioral testing techniques. *Journal Occupational Med.* 33(11), 1156-1162. <http://dx.doi.org/10.1097/00043764-199111000-00012>

Anderson, W. L. (1989). "Attention, Taste and Time" *The effective teacher: study guides and readings*. Edited by L.W. Anderson, Mc Graw-Hill Book Company, New York, s. 280.

Angell, J. R., & Moore, A. V. (2000). 'A study in attention and habit.' Chicago: Studies from the psychological laboratory of the University or Chicago.

Azboy, O., Erer, O., Oymak, Ö., & Tunç, Ö. (2012). *Spor psikolojisi ders kitabı*. Millî Eğitim Bakanlığı Yayıncılığı Devlet Kitapları 3. Baskı, 53-54.

Baboo, N. S., Rajan, B. K., Ramachandra, D. L., & Venkatesh, D. (2002). 'Impact of psychological stress, gender and colour on visual response latency. *Indian J Physical Pharmacol*, 46(3), 333-337.

Bayar, P., & Koruç, Z. (1992). *Reaksiyon zamanı ve el-göz koordinasyonu ölçer iki aracın türkiye normlarının saptanmasına yönelik ön çalışma sonuçları*. Ankara: H.Ü. Spor Bilimleri ve Teknolojisi Yüksek Okulu Yayıncı, Spor Bilimleri.

Bompa, T. O. (1990). *Theory and methodology of training*. Second ed., Dubuque, Iowa, Kendall Hunt Publishing Co., 316, 318-319.

Bompa, T. O. (2003). *Antrenman kuramı ve yöntemi*, Bağırgan Yayınevi, 2. Baskı, Ankara, 336-338.

Chan, J. W., Eysenck, H. J., & Lynn, R. (1991). Reaction times and intelligence among Hong Kong children. *Perceptual & Motor Skills*, 72, 427-433. <http://dx.doi.org/10.2466/pms.1991.72.2.427>

Davis, B et al. (1995). *Physical education and sport* 2th ed. USA, Human Kinetics.

Ganong, W. F. (2001). *Review of medical physiology*. San Francisco: McGraw-Hill, 49-51.

Gordon, C. C., Chumlea, W. C., & Roche, A. F. (1988). "Stature, recumbent length, and weight." Anthropometric standardization reference manual. Champaign: Human Kinetics Books: 3-8.

Guzzetta, F., Mercuri, E., Bonanno, S., Longo, M., & Spano, S. (1993). Autosomal recessive congenital cerebellar atrophy. *Brain Development*, 15, 439-445. [http://dx.doi.org/10.1016/0387-7604\(93\)90084-1](http://dx.doi.org/10.1016/0387-7604(93)90084-1)

Janelle, C. M. (2002). Anxiety, arousal and visual attention: A mechanistic account of performance variability. *Journal of Sport Sciences*, 20(3), 237-251. <http://dx.doi.org/10.1080/026404102317284790>

Ja-Song, M., & Lynn, R. (1993). Sex differences in reaction times decision times and movement times in british and korean children. *The Journal of Genetic Psychology*, 154(2), 209-213. <http://dx.doi.org/10.1080/00221325.1993.9914734>

Karagöz, Ş. (2008). *8-10 yaş arası çocukların 12 haftalık tenise özgü antrenmanlarının görsel ve işitsel reaksiyon zamanına etkisinin incelenmesi*. Afyon Kocatepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beden Eğitimi ve Spor Anabilim Dalı. Yüksek Lisans Tezi, Afyon.

KarakAŞ, S. (2012). *Ortaöğretim psikoloji ders kitabı*. Devlet Kitapları II. Baskı, Milli Eğitim Bakanlığı Yayıncıları, Ankara.

Karakoç, Ö., Çoban, B., & Konar, N. (2012). *İşitme engelli milli sporcular ile spor yapmayan işitme engellilerin benlik saygısı düzeylerinin karşılaştırılması*. Selçuk Üniversitesi Beden Eğitimi Ve Spor Bilim Dergisi, 14(1), 12-17.

Karbek, K. (1990). *Biyoloji* Ant Yayıncıları. Ankara.

Kolayış, H. (2000). *Okçularda kaygının reaksiyon zamanı ve atış puanına etkisi*. Yüksek Lisans Tezi. Hacettepe Üniversitesi. Ankara.

Lechair, A. D., Pollock, B. J., & Elliot, D. (1993). Movement preparation in adult with and without down syndrome. *American Journal of Mental Retardation*, 97(6), 628-633.

Lohman, T. G., Roche, A. F., & Martorell, R. (1988). Anthropometric standardization reference manual, Illinois: *Human Kinetics Books*. 3-8. <http://dx.doi.org/10.1080/00140138808966796>

Lynn, R., Cooper, C., & Topping, S. (1990). Reaction times and intelligence. *Current Psychology, Research & Reviews*, 9(3s), 264-276. <http://dx.doi.org/10.1007/bf02686864>

Morgan, T. C. (1977). *Psikolojiye Giriş. Ders kitabı*. (Çeviren: S. Karataş). A brief introduction to psychology, McGraw Hill Brook Company, Newyork, U.S.A.

Myung, J. A., & Lynn, R. (1992). Reaction times and intelligence in Korean children. *The Journal of Psychology*, 126(49), 421-428. <http://dx.doi.org/10.1080/00223980.1992.10543375>

Orhan, S. (2014). Aktif Sporcu ve sedanter öğrencilerin reaksiyon zamanı, dikey sıçrama ve anaerobik güç değerlerinin karşılaştırılması. *Spor ve Performans Araştırmaları Dergisi*, 5(2), 59-67.

Sarı, Ç. S. (2012). *Çeviklik alıştırmaları ve oyunlarının 10-11 yaş arası çocukların reaksiyon zamanları ve işlemleme hızına etkisinin incelenmesi*. Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü, Doktora Tezi. İstanbul.

Shigehisa, T., & Lynn, R. (1991). Reaction time sand intelligence in Japanese children. *International Journal of Psychology*, 26, 195-202. <http://dx.doi.org/10.1080/00207599108247886>

Taimela, S., & Kujala, U. M. (1992). Reaction times with reference to musculoskeletal Complaints in adolescent. *Perceptual and Motor Skills*, 75, 1075-1082. <http://dx.doi.org/10.2466/pms.1992.75.3f.1075>

Tamer, K. (2000). *Sporda fiziksel-fizyolojik performansın ölçülmesi ve değerlendirilmesi*. Ankara: Bağırgan Yayımevi, 139-140.



This work is licensed under a [Creative Commons Attribution 3.0 License](http://creativecommons.org/licenses/by/3.0/).